2:40pm - 2:50pm

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Advisor:

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In collaboration:

Dr. Matteo Garbelotto

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Panel:

The status of true fir species in California

An evaluation of *Heterobasidion* control and long-term monitoring/management in mixed coni*fir* forests of California

Mixed coni*fir* forests of California

Distribution and environmental services

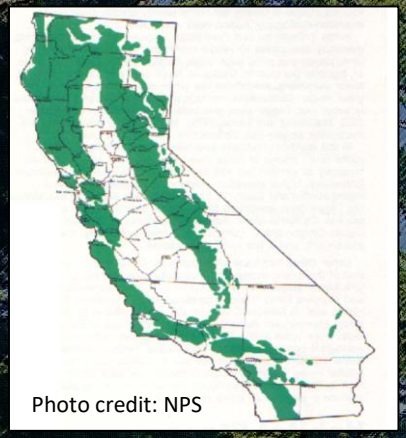


Photo credit: NPS

Provisioning

Photo credit: USFS

Regulating

Photo credit: Adrian Poloni

Recreation

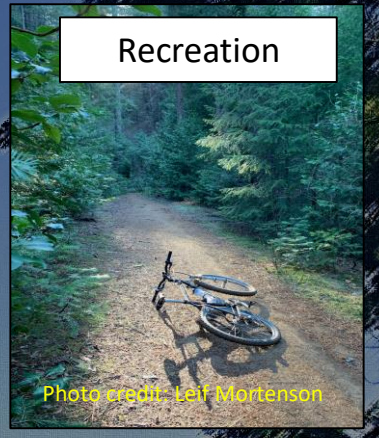


Photo credit: Leif Mortenson

Important service that depend on forest health

Abiotic and biotic forest disturbance agents

Fire

Photo credit: USFS

Drought

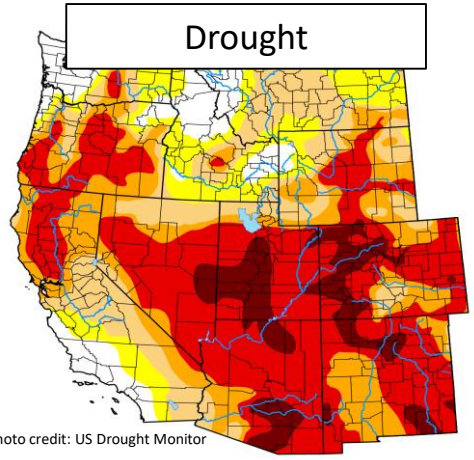


Photo credit: US Drought Monitor

Historic management

Photo credit: W. Woodruff

Forest pests

Photo credit: USFS

Disturbances can be apparent, episodic, and cyclical

Mixed conifir forests of California

CALIFORNIA FIRS

FIR ENGRAVER

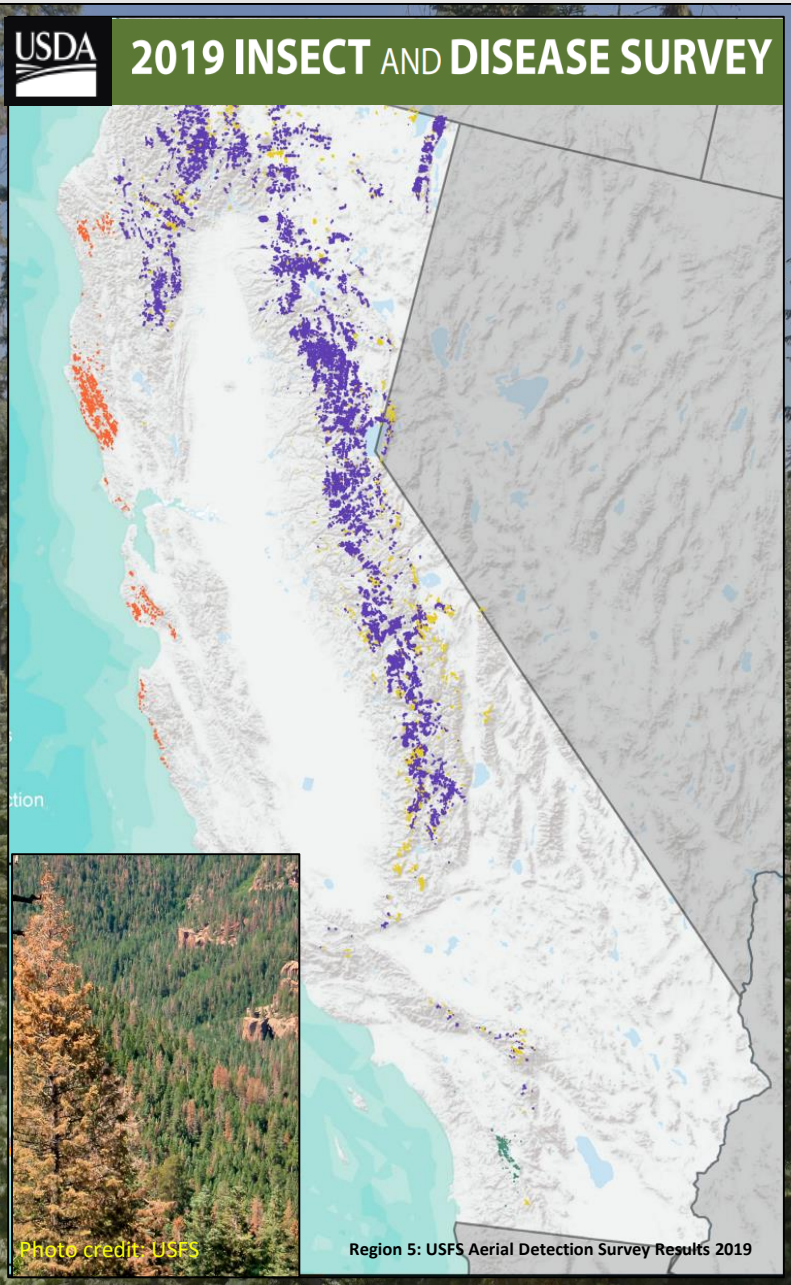
FIR ENGRAVER
12.4 MILLION TREES
IN 2019

Scolytus ventralis:

- Native bark beetle
- Infests true firs weaken by:
  - Drought
  - Windthrow
  - Defoliators
  - Logging slash
  - **Root disease**
  - **Wounded trees**

Management

- Felling infested trees
- Stand thinning (+ tree vigor)



Heterobasidion root disease (Annonsus root disease)

"S type" = *Heterobasidion occidentale* = **Ho**

- Abundant/native disease of conifers
- Causes: root rot, butt root & heartwood decay
- Result: tree failure, insect infestation, mortality

Difficult to detect:
-Asymptomatic trees
-Similar pests
-Historic stand conditions?

Difficult to determine
-Root contact
-Stumps
-Wounds, right?
-Fire damage?
-Wind throw?

Management

- Detection & evaluation

-Asymptomatic or other pests?
-Historic conditions?

- Prevention & suppression

-Sporax all stumps at recreation sites?
-Sporax all stumps in commercial stands?
-Wounds? (be careful!)

An evaluation of *Heterobasidion* control and long-term monitoring/management in mixed coni*fir* forests of California

Outline

FIELD EXPERIMENT

Blodgett Forest RS

Evaluate chemical treatments on Ho colonization in wounds & stumps

LAB EXPERIMENT

Cal Poly

Preliminary results of three chemical treatments

LONG TERM MONITORING

Stanislaus National Forest

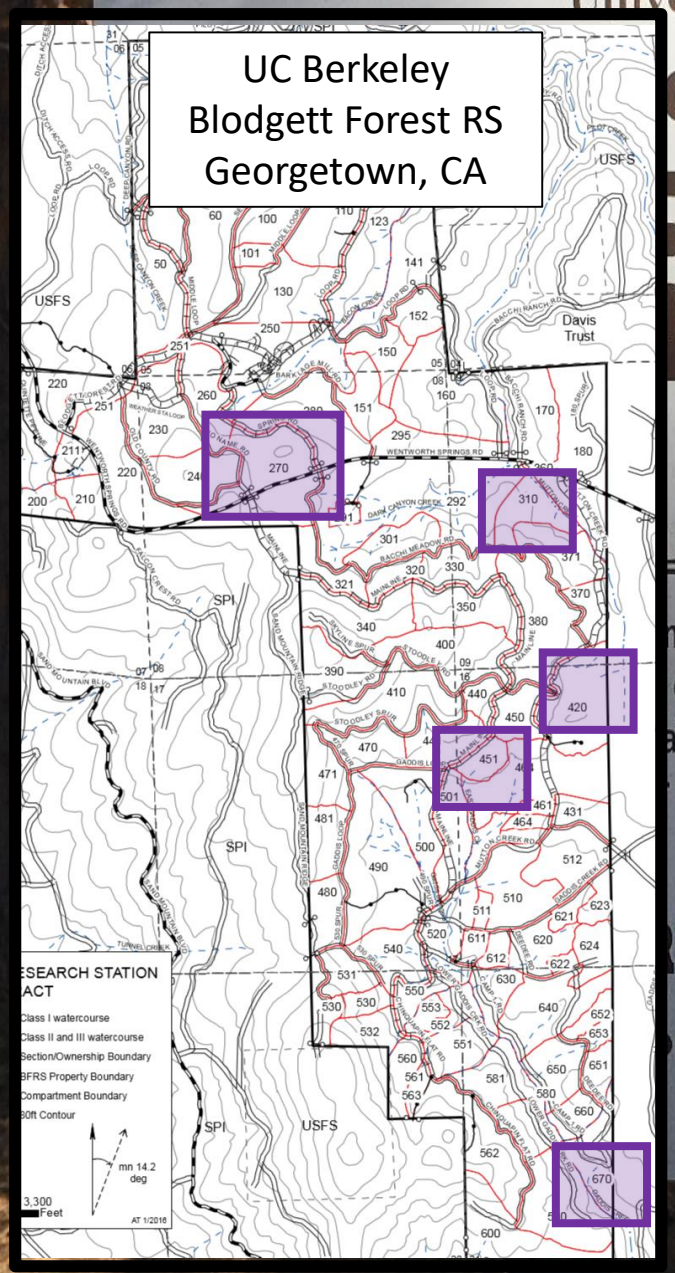
Illustrate some dynamics of mixed conifer forests affected by Ho

Communicate about new experiments and some preliminary results

Think about the current status of true fir forests in California and consider future management

Thank you for your attention and look forward to your comments/questions

Field experiment: July 2019



Recorded tree data:

Tree height (m)

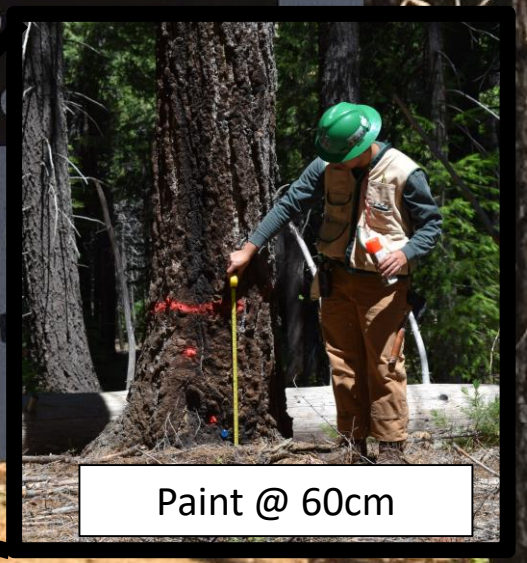
Tree canopy height (m)

Diameter breast height (DBH = 1.37m)

Diameter root collar (@ .25m)

Tree health (1-5)

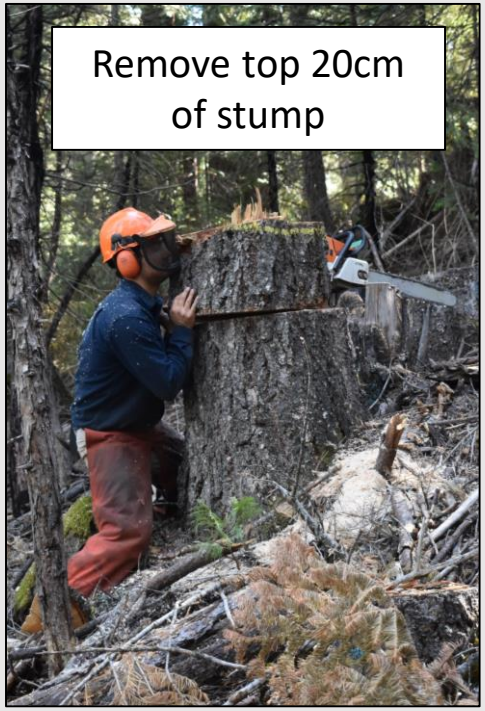
Observations:
(pest symptoms, fire, wounds)



Field experiment: October 2019

154 white fir were harvested

STUMP EXPERIMENT



Stump treatments

Borate solution: -Similar to Sporax -Historic treatment	**Control:** Dionized water	**P. gigantea:** Native saprotroph (biocontrol)	**Urea:** Agriculture fertilizer

180 standing white fir

WOUND EXPERIMENT

Wound treatments

Borate solution: Similar to Sporax Historic treatment	**Control:** Dionized water	**Ho:** Positive control	**Urea:** Agriculture fertilizer

Hereafter all stumps and wounded trees were undisturbed @ Blodgett Forest RS

Field experiment: October 2020

Revisited 120 treated white fir stumps

STUMP EXPERIMENT

Debarked stumps

collected wood disc sample

Bagged, treated, transported

180 white fir standing

WOUND EXPERIMENT

Recorded observations

Extracted wood core sample from each wounded tree

Sampling completed October 2020

All samples are examined for presence/absence of Ho conidia

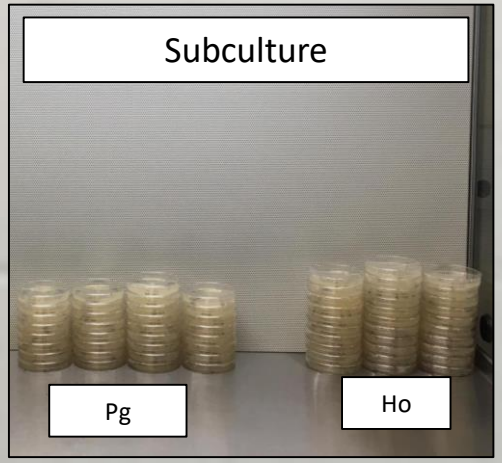
Amount & concentration of Ho conidia could indicate efficacy of treatments to prevent/minimize establishment of Ho

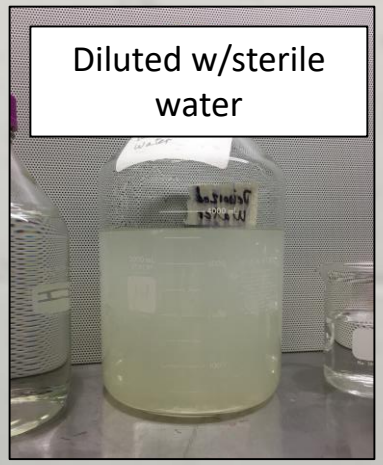
PENDING RESULTS….

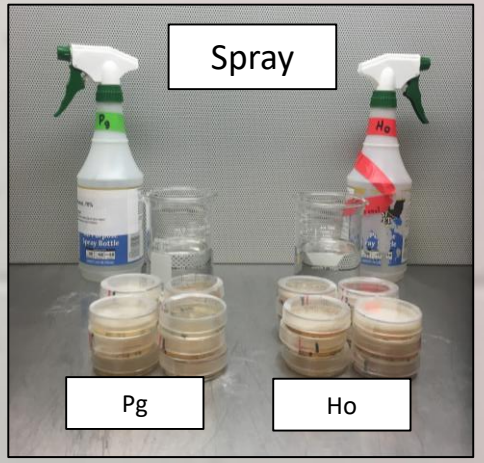
In the meantime…

Lab experiment: Fall 2019-2020

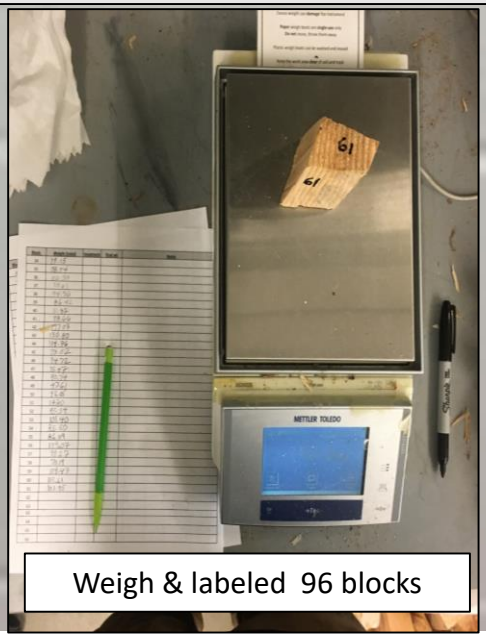
Prepared suspension -> treatment







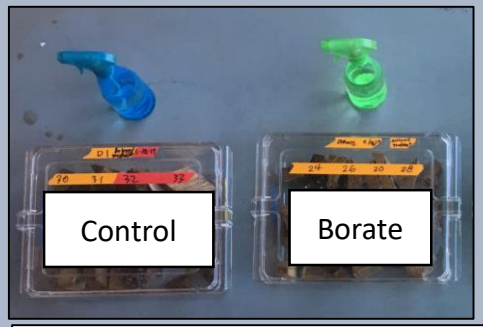
Prepared Wood block samples

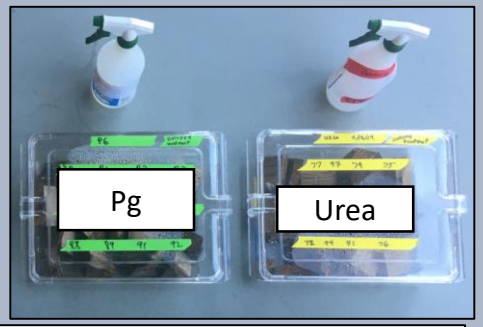


Lab experiment: Fall 2019

Group 1: Immediate treatment

Treated all blocks





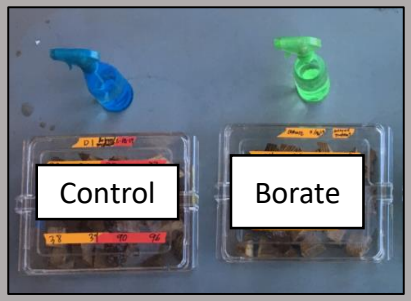
Ho inoculum over the treated block

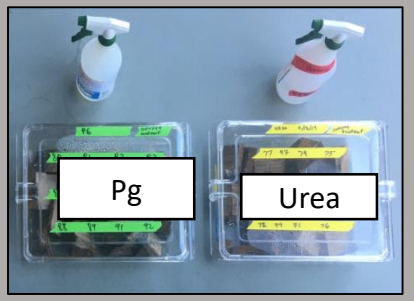
Incubated Nov.2019 – Oct. 2020

Group 2: Delayed treatment

Ho inoculum

Treated 5 days later



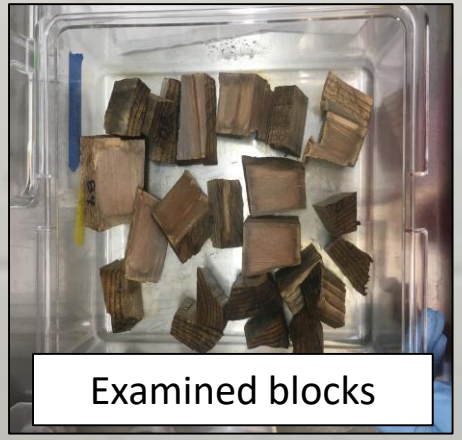


Incubated Nov. 2019 – Oct. 2020

Lab experiment: Fall 2020

October 1st, 2020

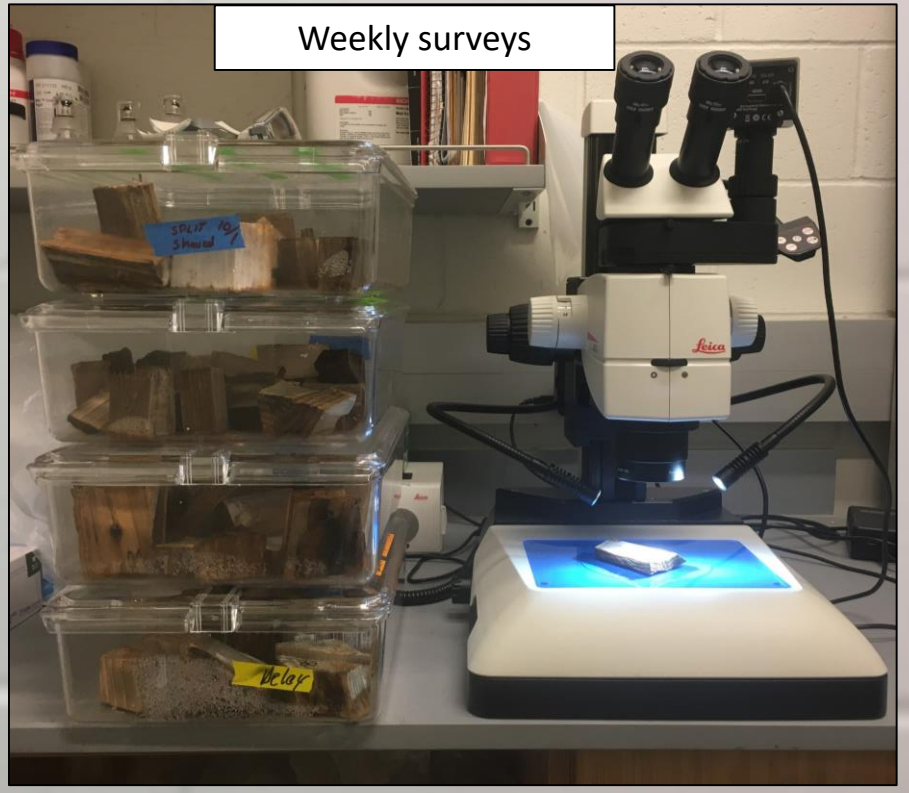
Split & shaved



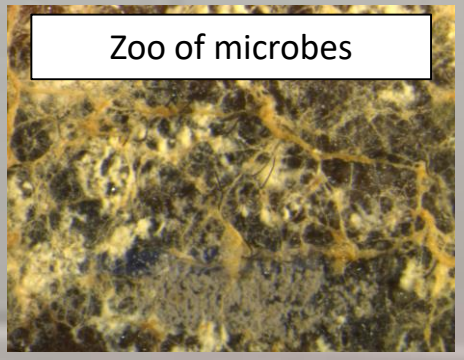
Examined blocks

Incubated

October 9th – 30th, 2020



Weekly surveys

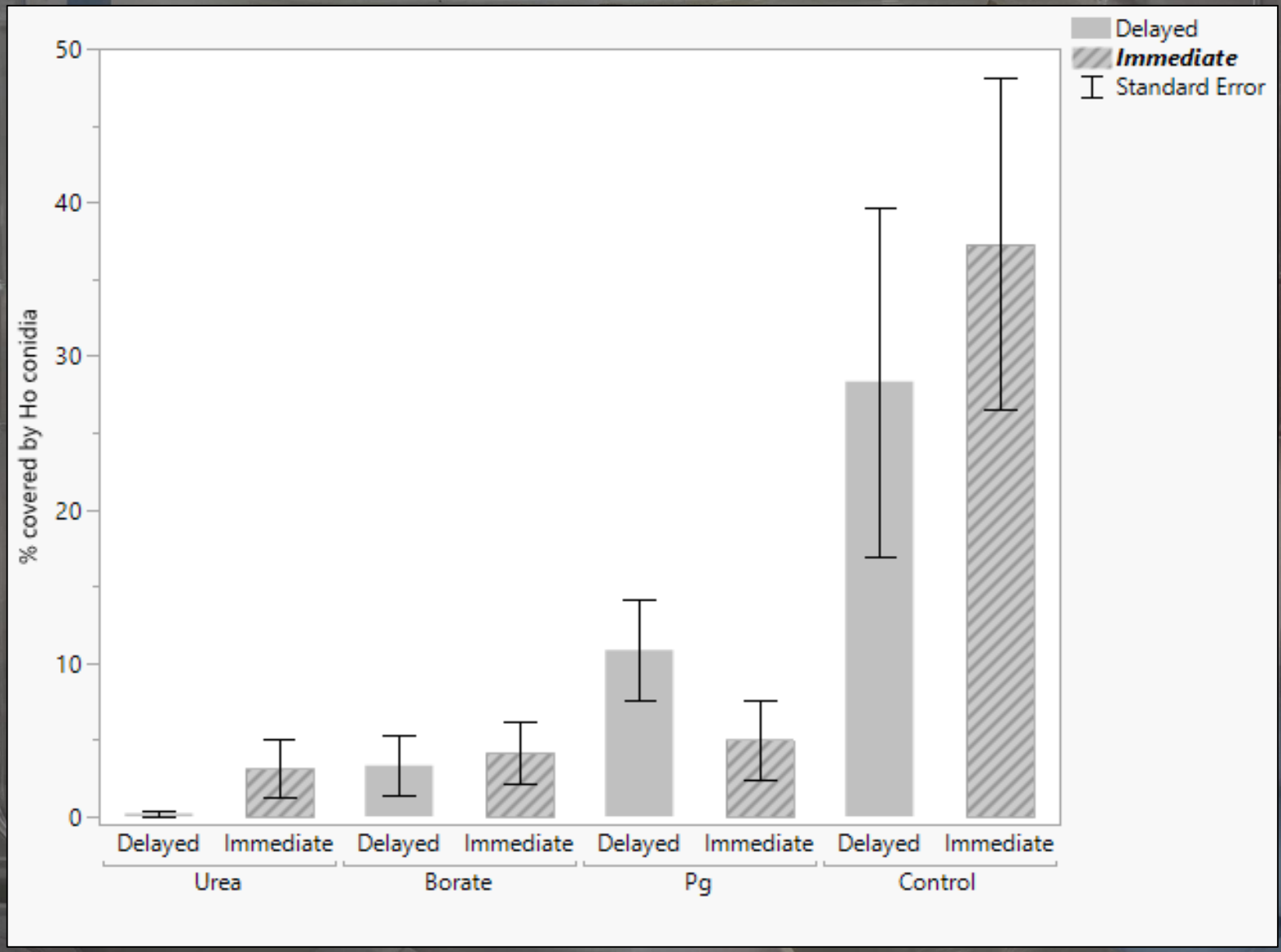


Zoo of microbes

Count of Ho conidia

Preliminary results: Lab experiment fall 2020

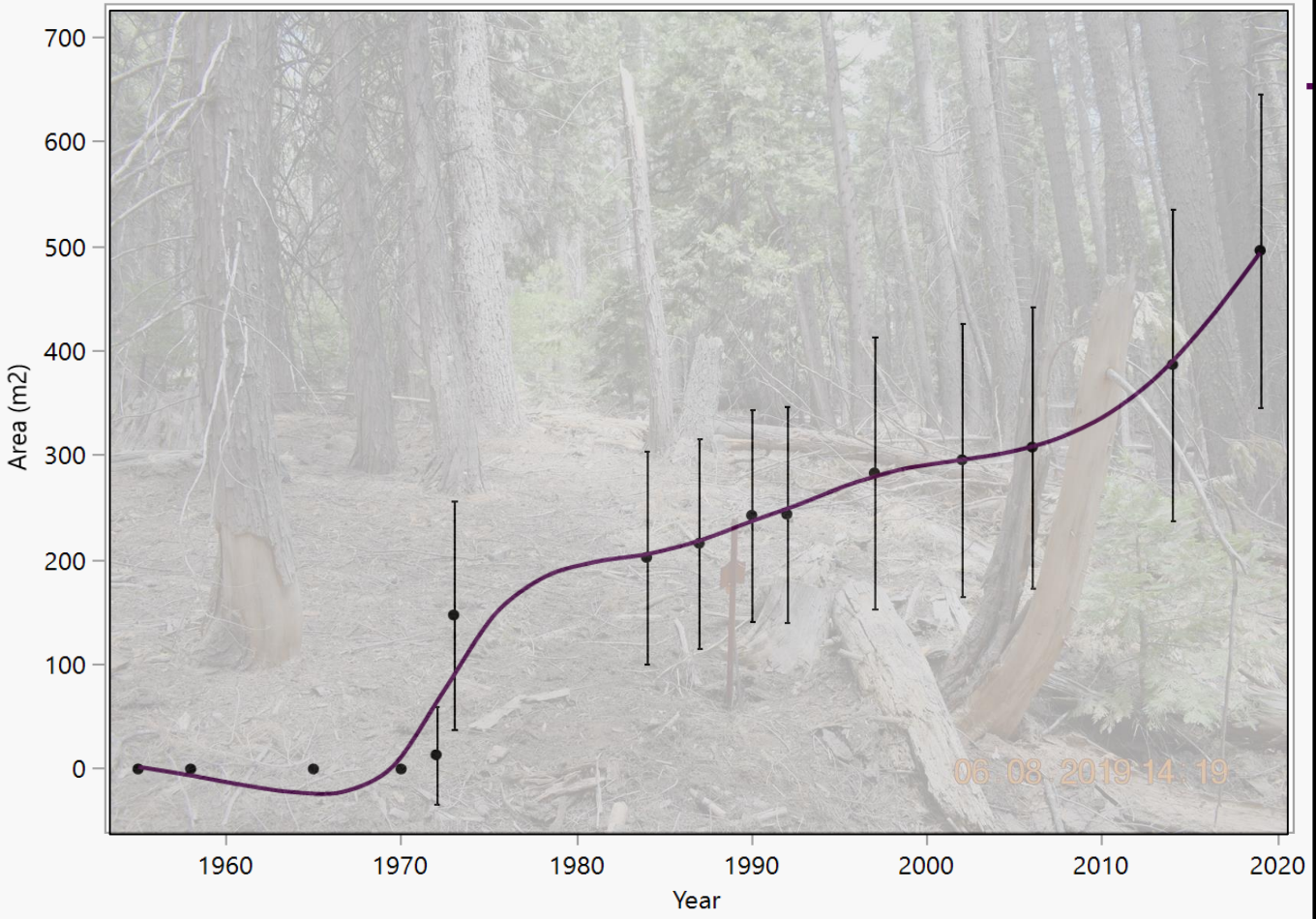
Figure 1: Treatment and treatment timing on Ho conidia concentration



Long-term monitoring for *Heterobasidion* root disease in mixed conifer forests of California

Preliminary results (briefly)

Figure 2: Mean area of *H. occidental* root disease centers on the Stanislaus NF



23 plots following all trees around Ho infected white fir stump

Resurveyed 6-9 years 1972-2019

40+ years monitoring

Over 1,000 trees

Tree mortality = increase in disease center area

Gap area increased in size (m2) over time

Evidence of Ho persistent in mixed conifer forest

White fir stumps NOT TREATED

Preliminary conclusions…

- *H. occidentale* can be a persistent forest pest that affects true firs and mixed conifer forest of California
- Ongoing field experiments can:
  - Evaluating chemical treatments to manage *H. occidentale* root disease
  - inform potential management strategies in mixed conifer forests
- Stay tuned and let's continue to enjoy true fir forests…

Thank you for your attention

Acknowledgements

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Chris Lee (Cal Fire)
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Unidentified field crew*

Questions, corrections, comments, etc.

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